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(56) Documents Cited
GB 2179307 A GB 2159185 A GB 1265123 A
GB 1126530 A US 4242779 A

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(54) Abstract Title
Manufacture of ply for tyres

(57) A ply material for use in tyres comprises a pair of parallel anchor cords (102, Fig 6) and a plurality of cord windings. Each winding passes around both anchor cords (102), and each winding is positively located against axial movement of each of the anchor cords by circumferential grooves in the cords. Rotation of a sleeve 32 causes cord to be dispensed from bobbins 48 , passed to the tips of arms 36 and from there wound round spindles 42 within which the anchor cord is supplied. The wound cord is then passed via a rubberising calender 14, a press (16, Fig 1) and a lining calender (18) to a trimmer (20).

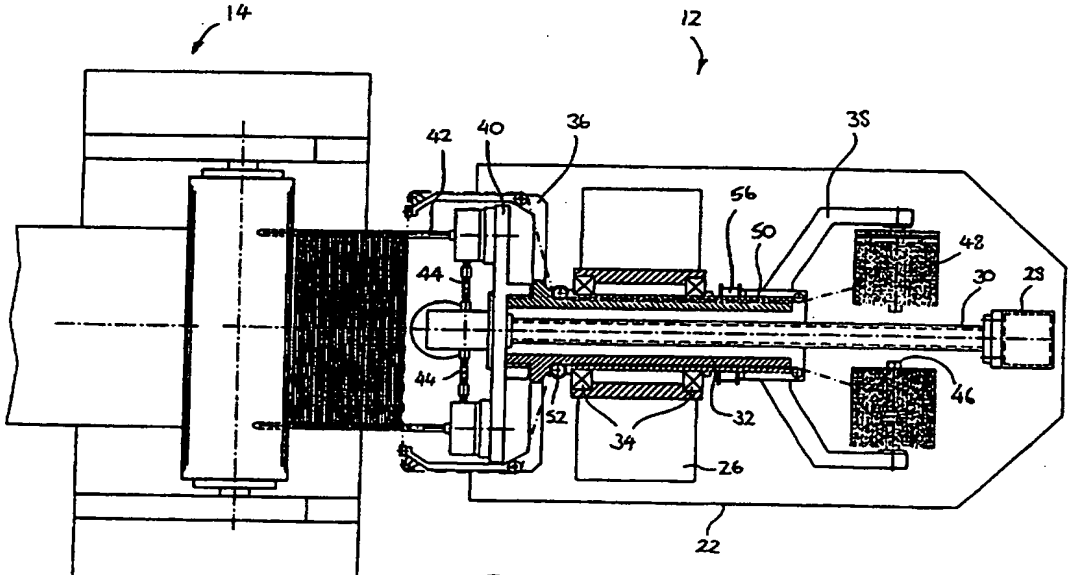

FIGURE 3

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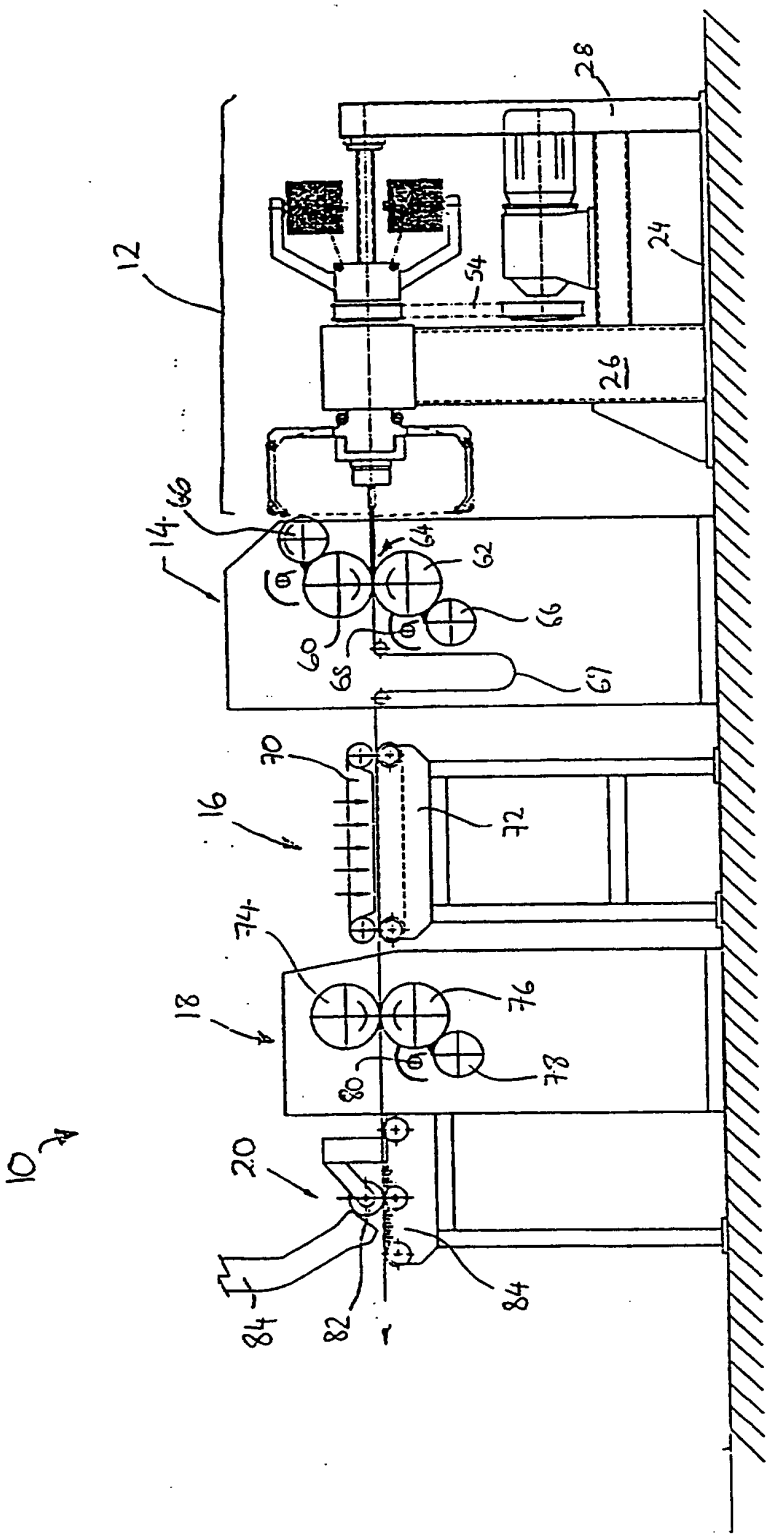

FIGURE 1

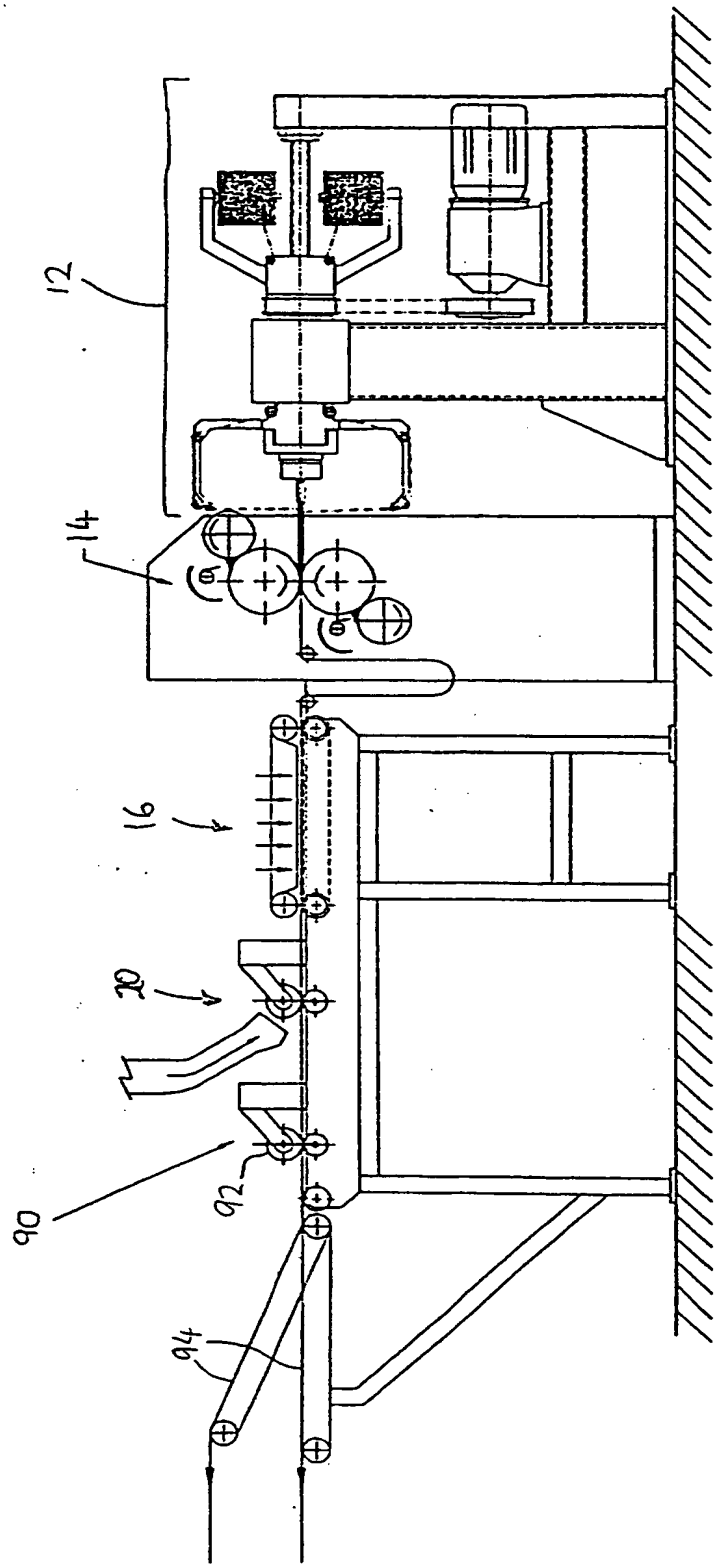

FIGURE 2

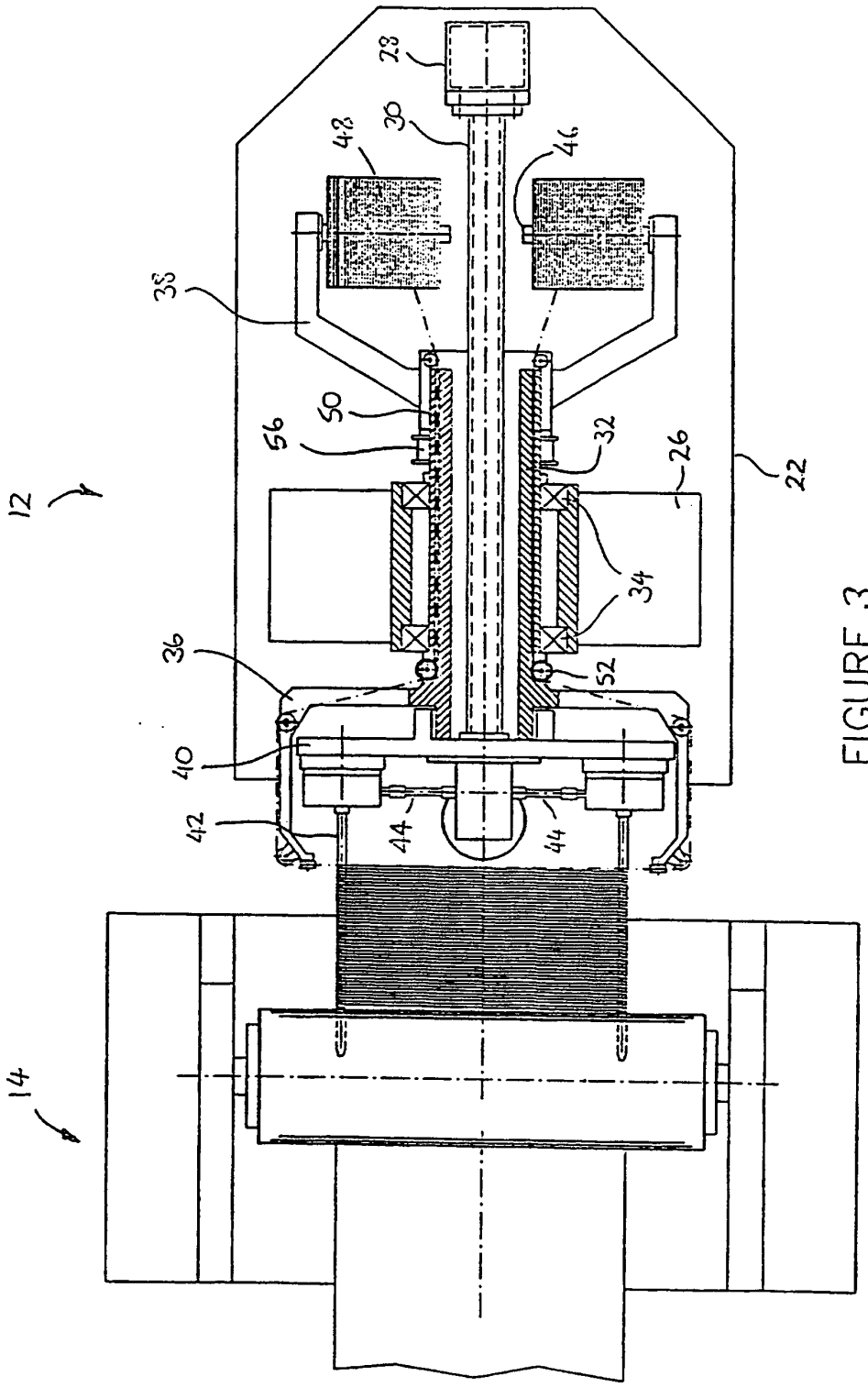

FIGURE 3

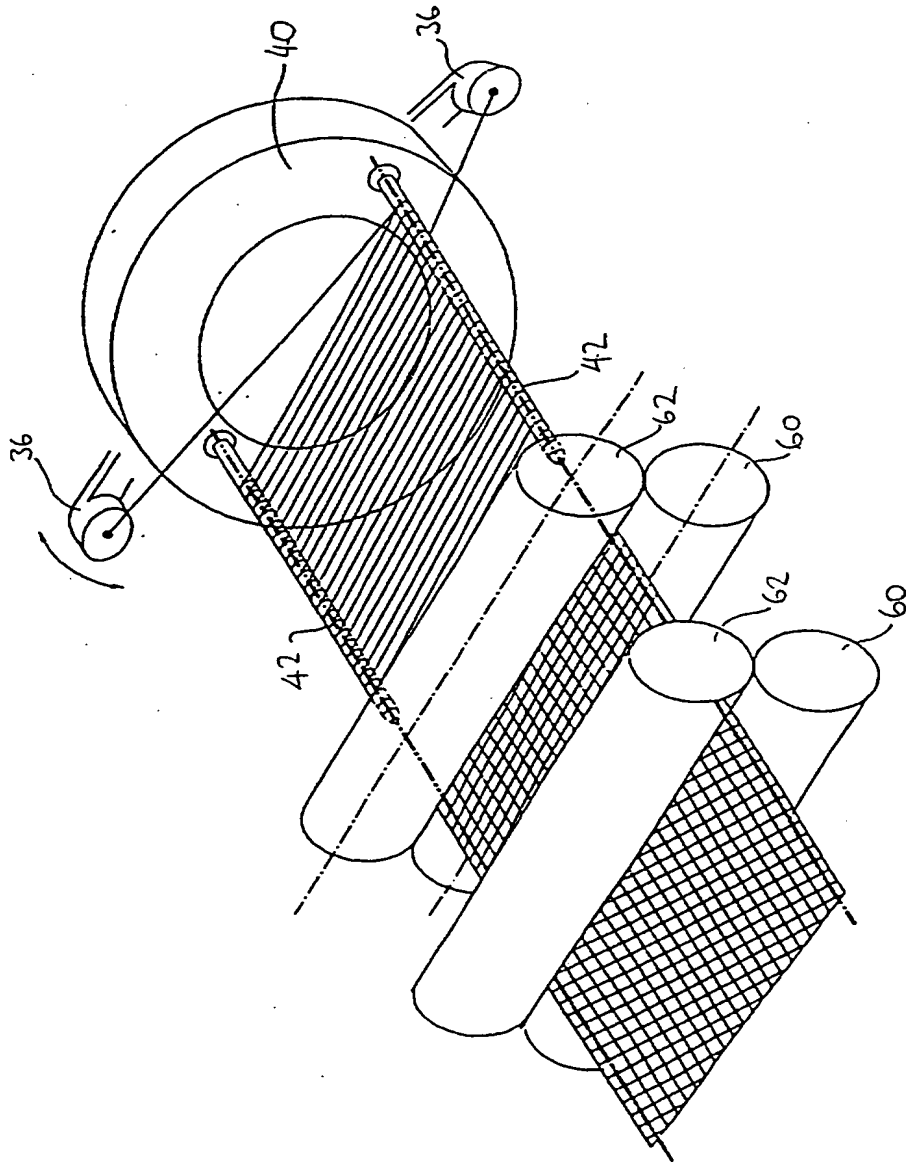

FIGURE 4

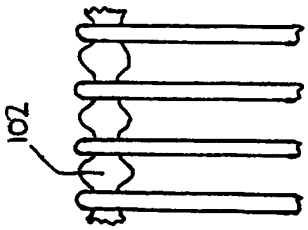

FIGURE 6.

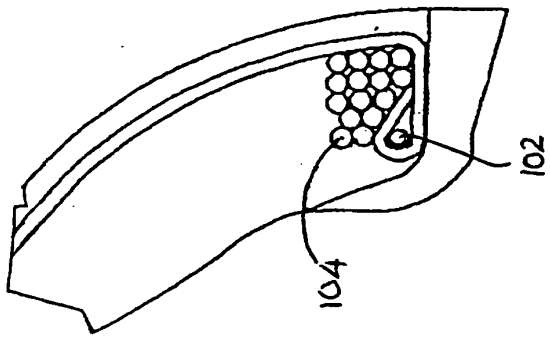

FIGURE 5

Title: Improvements in Tyre Manufacture

This invention is concerned with improvements in tyre manufacture, particularly with regard to the locking of a ply layer in the region of a tyre bead.

The ply layer of a tyre should be held in the region of the bead in order to enable the ply to support tension forces in the tyre. Without means for holding the ply in that way, the ply would tend to pull away from the bead region of the tyre.

U.K. Patent Application GB-A-2179307 describes a ply material which comprises a continuous cord wound around a pair of bead wires. The wires define the edges of the ply, and further wires may be wound about the edges of the ply to further define a bead package. Generally, the bead package comprises a continuation of the bead wire looped inside the ply, by forming a length of the ply by winding cord around the bead wire, halting the winding of the cord and advancing bead wire to provide sufficient length thereof to form the remainder of the bead package.

Although that system provides a bead with adequate integrity, it requires the ply winding process to be interrupted at regular intervals. That can cause irregularities in production, and will increase wear and reduce reliability.

Any discontinuities in the ply will cause substantial structural weakness in the finished tyre. Such discontinuities could be

magnified by major distortions imparted on the ply by means of the tyre forming process; generally, the ply is manufactured in a flat profile and must be distorted into a toroidal shape.

It is an object of the present invention to provide a ply material which has a decreased likelihood of containing structural defects of the type identified above.

According to a first aspect of the invention, there is provided a ply material comprising a pair of parallel anchor cords, and a plurality of cord windings, each winding passing around both anchor cords, and wherein each winding is positively located against movement axially of each of the anchor cords.

In that way, the ply has a sturdy construction and does not suffer from the rucking or separation of ply cords which could cause severe weaknesses in a finished tyre.

Each of the anchor cords preferably comprises a plurality of circumferential grooves, each groove being arranged to receive a portion of winding such that the winding is retained against movement axial of the anchor cord.

In a preferred embodiment of the invention, the plurality of windings is comprised of a continuous cord wound helically around the pair of anchor cords. The plurality of windings may be comprised of two continuous cords wound helically around the pair of anchor cords.

The anchor cords are preferably of plastics material. It will be understood that the grooves in the anchor cords may also be helical, or they may extend only partially around the cord.

According to a second aspect of the invention, there is provided a method of manufacturing a ply comprising the steps of providing two anchor cords in parallel and placing windings of a ply cord material thereabout such that successive windings of said ply cord are located against movement axially of the anchor cords.

In a preferred embodiment of the invention, each of the anchor cords comprises a plurality of substantially circumferential grooves, and the step of placing windings comprises the step of placing each winding in a groove such that the winding is retained against movement axial of the anchor cord.

The step of placing windings may comprise the step of winding a continuous cord helically around the pair of anchor cords.

The step of placing windings may comprise the step of winding two continuous cords helically around the pair of anchor cords.

Further aspects and advantages of the invention will be apparent from the following description of a specific embodiment of apparatus in accordance with the invention with reference to the accompanying drawings, in which:

Figure 1 is a side elevation of a ply manufacturing station on which ply according to a specific embodiment of the invention can be manufactured;

Figure 2 is a side elevation similar to that illustrated in figure 1 of another ply manufacturing station;

Figure 3 is a detail plan of the winding apparatus illustrated in figures 1 and 2;

Figure 4 is a schematic view of the winding apparatus of preceding drawings showing a preferred mode of operation.

Figure 5 is a cross section through a portion of tyre incorporating the ply of the specific embodiment of the invention; and

Figure 6 is a fragmentary plan view of ply of the specific embodiment of the invention.

Referring to figure 1, a ply forming station 10 comprises a ply winding apparatus 12, a rubberising calender 14, a press 16, a lining calender 18 and a trimmer 20. Those components are aligned in the order stated above.

The winding apparatus 12 is described more particularly with reference to figure 3. A turret 22 comprises a base 24 and front and rear upstanding members 26, 28. A generally horizontal axle

30 is journalled in the upper end of the rear upstanding member 28, and extends towards the front of the turret 22.

A tubular sleeve 32 is arranged coaxially with the axle 30, and is journalled, via bearings 34, in the front upstanding member 26. The sleeve 32 is rotatable relative to the turret 22. At the front end of the sleeve 32, a pair of arms 36 extend radially outwardly. The arms 36 are diametrically opposed. Each arm 36 has a radial portion, and at the end of the radial portion a portion at right angles thereto, i.e. parallel with the axis of rotation of the sleeve 32. The axial portion extends forward of the turret 22.

At the rear end of the sleeve 32, a similar pair of arms 38 are mounted thereon; they are oriented generally towards the rear of the turret 22. The arms 36, 38 are generally coplanar.

A front plate 40 is mounted on the front end of the axle 30, adjacent the front end of the sleeve 32. The front plate 40 is generally planar and is oriented in a plane at right angles to the axle 30. The front plate 40 comprises a pair of spindles 42 extending forwardly of the front plate 40 and parallel to the axle 30. The spindles 42 are equally spaced either side of the axle 30.

Each spindle 42 has a helical groove in the surface thereof. Each spindle is arranged to rotate relative to the plate; drive to the

spindles 42 is conducted via shafts through the axle 30 and side shafts 44.

Each of the arms 38 has a radially inwardly extending pin 46 on which is provided a bobbin 48 of cord. The sleeve 32 has a pair of parallel axial channels 50, diametrically opposed about the axis of the sleeve 32, and along which cord is conducted from respective bobbins 48 to the front of the sleeve 32 and therefrom to the tips of the arms 36.

The arms 36, 38 and the channels 50 are all provided with pulley wheels 52 to assist the passage of cord to the tips of the arms 36.

The sleeve 32 is rotated by a drive motor situated on the turret 22. The drive is transferred by means of a belt 54 riding in a flanged wheel 56. On rotation of the sleeve 32, cord is dispensed from the tips of the arms 36, and wound around the spindles 42. The cord will ride in the helical grooves, and by rotation of the spindles, the wound cords will traverse away from the front plate towards the ends of the spindles 42.

The rubberising calender 14 is arranged to receive wound cord from the winding apparatus 12. The calender 14 comprises upper and lower inner rollers 60, 62, arranged in parallel. The inner rollers 60, 62 are oriented at right angles to the spindles 42, and define a nip 64 into which the ends of the spindles 42 extend. Hence, cords wound on the spindles are delivered into the

nip 64. The inner rollers 60, 62 in use rotate in opposite directions so as to draw the wound cord from the spindles and into the nip 64.

Each of the inner rollers 60, 62 has a respective outer roller 66 arranged thereagainst. Hence, the rubberising calender 14 is known as a "four bowl" calender. A delivery outlet 68 is arranged between each inner and outer roller combination 60, 66, 62, 66, and out of which is delivered pellets of elastomeric material. Those pellets are squeezed between the inner and outer roller and become a coating on the surface of the inner roller. That coating is transferred in use to either side of the wound cord passing through the nip 64 between the inner rollers 60, 62.

The calender 14 further includes an accumulator 69 to which the coated cord is passed after exiting the nip 64. The accumulator prevents minor variations in speed in the process from causing ply to break.

The press 16 comprises a top plate 70 and a bottom plate 72, between which successive portions of the coated wound cord exiting the rubberising calender 14 are pressed. The effect of that is to push the elastomeric material through the windings of the wound cord to achieve strike through. In that way, a ply material having cord embedded therein is formed.

The lining calender 18 is situated to receive ply from the press 16. The lining calender 18 is a three bowl calender, in that it

comprises three rollers 74, 76, 78 arranged one above another in parallel. The ply is passed between the upper two rollers 74, 76, in use. The lowest roller 78 is served by a delivery outlet 80 which deposits pellets of elastomeric material between the lowest roller 78 and the roller 76 adjacent thereto. The deposited material forms a layer on the adjacent roller 76 which is subsequently transferred to the ply passing through the calender 18. Accordingly, the calender 18 forms a lining layer on the ply.

The trimmer 20 comprises a cutter 82 arranged above a roller track 84 . The cutter is positioned to divide the ply passing therethrough into a pair of reinforced chafers. Hence the trimmer 20 is an optional feature which is only used in specific applications where chafer strips are to be produced. A trimming removal duct 86 is arranged to remove trimmings; trimmed elastomeric material can be recycled for future use.

The station illustrated in figure 2 is similar to that illustrated in figure 1. Those parts thereof which are common to the two stations are given the same reference numeral and will not be described further.

The station 100 of figure 2 includes a ply winding apparatus 12, a rubberising calender 14, a press 16, a trimmer 20 and a slitter 90. Those components are aligned in the order stated above. It will be appreciated that the station 100 does not include a lining calender 18, but that one could be provided if necessary.

Once ply has exited the trimmer 20, it enters the slitter 90. The slitter comprises a plurality of parallel slitting heads 92 arranged across the width of the ply to draw off a plurality of parallel strips of the ply material. Therefore, for convenience a number of small components may be produced out of a wide strip of ply material. The slitter 90 comprises a plurality of transporters 94 to separate and transport away the strips formed thereby.

Figure 4 shows a winding apparatus in schematic form. For guidance, the components of the winding apparatus, and portions of a calender, have been labelled with reference numerals appropriate to the specific embodiment described above.

Figure 4 shows in more detail features of the apparatus disclosed above. The spindles 42 of figure 4 are tubular, and serrated ply locking strip 102 is delivered down the tubular spindles. In that way the ply formed by the apparatus of figure 4 may incorporate bead wire at each edge thereof. Clearly, with ply locking strips being incorporated at each edge of the ply, the trimmer should suitably be finely adjusted or omitted altogether.

The ply locking strips can be more clearly seen in figure 6 which illustrates a portion of ply formed in accordance with the above apparatus and method. As shown, individual windings are located in serrations of the ply locking strips. Therefore, the windings are locked against movement relative the ply locking strips 102

and consequently, their spacing relative each other remains constant.

A ply formed in accordance with the above is illustrated in figure 5 incorporated in a tyre. Bead wire 104 is illustrated formed around the ply locking strip 102, and so a bead can be built up to an acceptable size.

The invention is particularly advantageous because it avoids discontinuities in the ply cord winding spacing which would otherwise affect the strength of a tyre so formed, and could lead to the failure of such a tyre.

Claims

1. A ply material comprising a pair of parallel anchor cords, and a plurality of cord windings, each winding passing around both anchor cords, and wherein each winding is positively located against movement axially of each of the anchor cords.

2. A ply material according to claim 1 wherein each of the anchor cords comprises a plurality of circumferential grooves, each groove being arranged to receive a portion of winding such that the winding is retained against movement axial of the anchor cord.

3. A ply material according to claim 1 or claim 2 wherein the plurality of windings is comprised of a continuous cord wound helically around the pair of anchor cords.

4. A ply material according to any preceding claim wherein the plurality of windings is comprised of two continuous cords wound helically around the pair of anchor cords.

5. A ply material according to any preceding claim wherein the anchor cords are of plastics material.

6. A method of manufacturing a ply comprising the steps of providing two anchor cords in parallel and placing windings of a ply cord material thereabout such that successive windings of

said ply cord are located against movement axially of the anchor cords.

7. A method according to claim 6 wherein each of the anchor cords comprises a plurality of substantially circumferential grooves, and the step of placing windings comprises the step of placing each winding in a groove such that the winding is retained against movement axial of the anchor cord.

8. A method according to claim 6 or claim 7 wherein the step of placing windings comprises the step of winding a continuous cord helically around the pair of anchor cords.

9. A method according to any one of claims 6 to 8 wherein the step of placing windings comprises the step of winding two continuous cords helically around the pair of anchor cords.

10. A ply material substantially as described herein, with reference to figures 5 and 6 of the accompanying drawings.

11. A ply material with ply locking strips and produced on apparatus substantially as described herein, with reference to the accompanying drawings.

12. A method of producing a ply material substantially as described herein and with reference to the accompanying drawings.

The Patent Office

Application No:	GB 9715451.2	**Examiner:**	C J Duff
Claims searched:	1 - 12	**Date of search:**	21 October 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): B7C(CMCC,CMCT,CMCX,CMQ), D1R(RABA,RABB,RABC,RABD)

Int Cl (Ed.6): B29D 30/00, 30/06, 30/08, 30/38, 30/42, 30/70; D04H 3/00, 3/02, 3/04

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 2179307 A	(APSLEY) Figs 1, 2, 3 (referred to in application)	
A	GB 2159185 A	(APSLEY) Whole document	
A	GB 1265123	(ISERE-NORD) Whole document	
A	GB 1126530	(MOULINAGE) Figs 1, 3	
A	US 4242779	(CURINIER) Whole document	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.